

Two New Shallow-water Mysids of the Genus *Heteromysis* (Crustacea: Mysidacea) from a Submarine Cave of Christmas Island, Eastern Indian Ocean

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Two new species of the shallow-water mysid genus *Heteromysis* (Crustacea: Mysidacea) are reported from a submarine cave on Christmas Island, eastern Indian Ocean. *Heteromysis dentata* sp. nov. is characterized by eyes without ocular processes, the telson with lateral spines along its distal half, the posteromedian cleft of the telson with spinules along its entire margin, and the four posterior thoracic endopods each with a seven-segmented carpopropodus. *Heteromysis longiloba* sp. nov. is characterized by eyes without ocular processes, the telson with lateral spines along slightly more than its posterior half, the posteromedian telson cleft with spinules only along its anterior margin, and the inward-curving endopods of the uropods bearing 12 mesial spines. The Indo-Pacific species of *Heteromysis* are briefly reviewed.

Key Words: Crustacea, Mysidacea, *Heteromysis*, new species, submarine cave, Indian Ocean.

The genus *Heteromysis* is placed in the tribe Heteromysini of the family Mysidae and currently includes over 60 species from the tropical and subtropical regions of the world. Taxonomic studies of the Indo-Pacific *Heteromysis* species have been made by several authors, notably W. M. Tattersall (1922, 1927a, b), O. S. Tattersall (1967), Băcescu (1979, 1983, 1986), Băcescu and Bruce (1980), and Murano (1988, 1998).

A recent survey, conducted as a part of extensive faunal research of submarine caves in the Indo-Pacific, yielded small collections of mysids from Christmas Island in the eastern Indian Ocean. The sample included two previously unknown species of *Heteromysis*, and they are described and illustrated here. In addition, the Indo-Pacific species of *Heteromysis* are briefly reviewed and their key characteristics are presented.

The type specimens are deposited in the Western Australian Museum, Perth (WAM), and the National Science Museum, Tokyo (NSMT).

Systematic accountsGenus *Heteromysis* S. I. Smith, 1873*Heteromysis dentata* sp. nov.

(Figs 1, 2)

Material. Holotype: ovigerous female, 4.4 mm in total length (WAM C 24973), stn. XM2, "Thundercliff Cave" diving site, north side of Christmas Island, 10°28'21.3"S, 105°36'24.6"E, 30 Nov. 1999, limestone cave more than 100 m long, seemingly connected to land limestone caves, 1.3–6 m deep, totally dark inside, with calcareous and muddy sand bottom, salinity 32‰, leg. S. Ohashi, S. Kinjo, T. Kase, I. Hayami, Y. Kano, and L. Kirkendale. Paratype: female, 4.0 mm in total length (NSMT), data same as for holotype.

Description. Body moderately robust, slightly depressed dorsoventrally (Fig. 1a). Rostrum triangular, directed slightly downwards, reaching midlength of first segment of antennular peduncle, lateral margin slightly concave (Fig. 1b). Carapace rounded dorsally, cervical sulcus indistinct; posterior margin excavate, leaving last thoracic somite uncovered in dorsal view; anterolateral margin rounded (Fig. 1a, b). Ventral sternites without processes.

Abdomen with anterior 5 somites subequal in length, sixth somite 1.33 times as long as fifth (Fig. 1a). No median ventral process present on pleon. Telson as long as or slightly longer than sixth abdominal somite, 1.3 times as long as basal width, subtriangular; lateral margins weakly concave, armed laterally with 5 spines on posterior two-fifths of each side, these spines increasing in length distally; apical lobe with 2 terminal spines, outer spine about 2.5 times as long as inner one; posteromedian cleft occupying one-fifth of length of telson, armed with 16–17 spinules along almost its entire margin, posteriormost spinule reaching base of apical spine (Fig. 1c, d).

Eye with cornea well pigmented, slightly narrower than stalk, without ocular process; mesial margin of eyestalk slightly hispid (Fig. 1b). Antennular peduncle robust (Fig. 1f); first segment with anterolateral corner strongly produced and tipped with several setae; second segment shortest, articulating obliquely with third segment, and with setae at distomesial margin; third segment widest, with seta near midlength of mesial margin, and 2 ordinary setae and spine with acuminate distal part (probably without subapical flagellum) on distomesial part. Length ratio from first to third segments along mesial margin = 1.0 : 0.62 : 0.77 (Fig. 1f). Antenna with elliptical scale, latter subequal in length to antennal peduncle, about 3 times as long as wide, setose all around margin (Fig. 1g). Mouthparts as illustrated (Fig. 2a–e).

Endopod of third thoracopod with ischium smooth on ventral margin; merus about 3 times as long as high, narrowing distally, armed with 2 flagellate spines near distal end of ventral margin, distoventral corner produced distally; carpopropodus slightly more than 2 times as long as high, ventral margin with marked swelling in proximal two-fifths, armed with 3 flagellate spines, 3 stout setae, and several fine setae on distal one-third; terminal claw strong, about half length of carpopropodus (Fig. 2f). Endopod of fourth thoracopod with 4-segmented carpopropodus. Endopods of fifth to eighth thoracopods each with 7-segmented carpopropodus (Fig. 2g). Pleopods each reduced to unsegmented lobe with pseudo-branchial lobe (Fig. 2h, i). Exopod of uropod slightly more than 1.5 times as long as

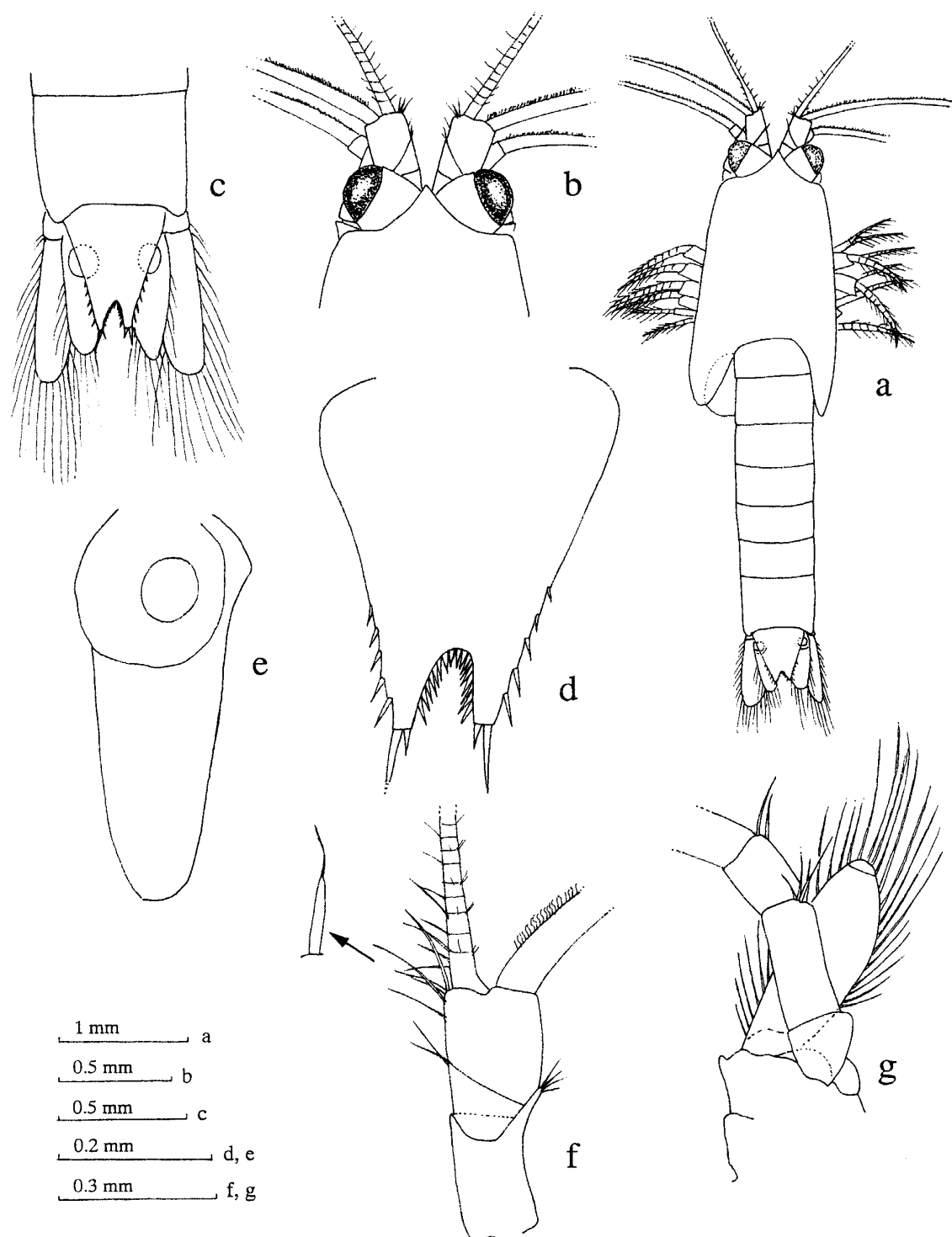


Fig. 1. *Heteromysis dentata* sp. nov. Holotype, ovigerous female (4.4 mm): a, entire animal, dorsal; b, anterior part of carapace and cephalic appendages, dorsal; c, sixth abdominal somite, uropod, and telson, dorsal; d, telson, dorsal; e, endopod of right uropod, ventral; f, right antennule, dorsal, with detail of acuminate spine; g, right antenna, ventral.

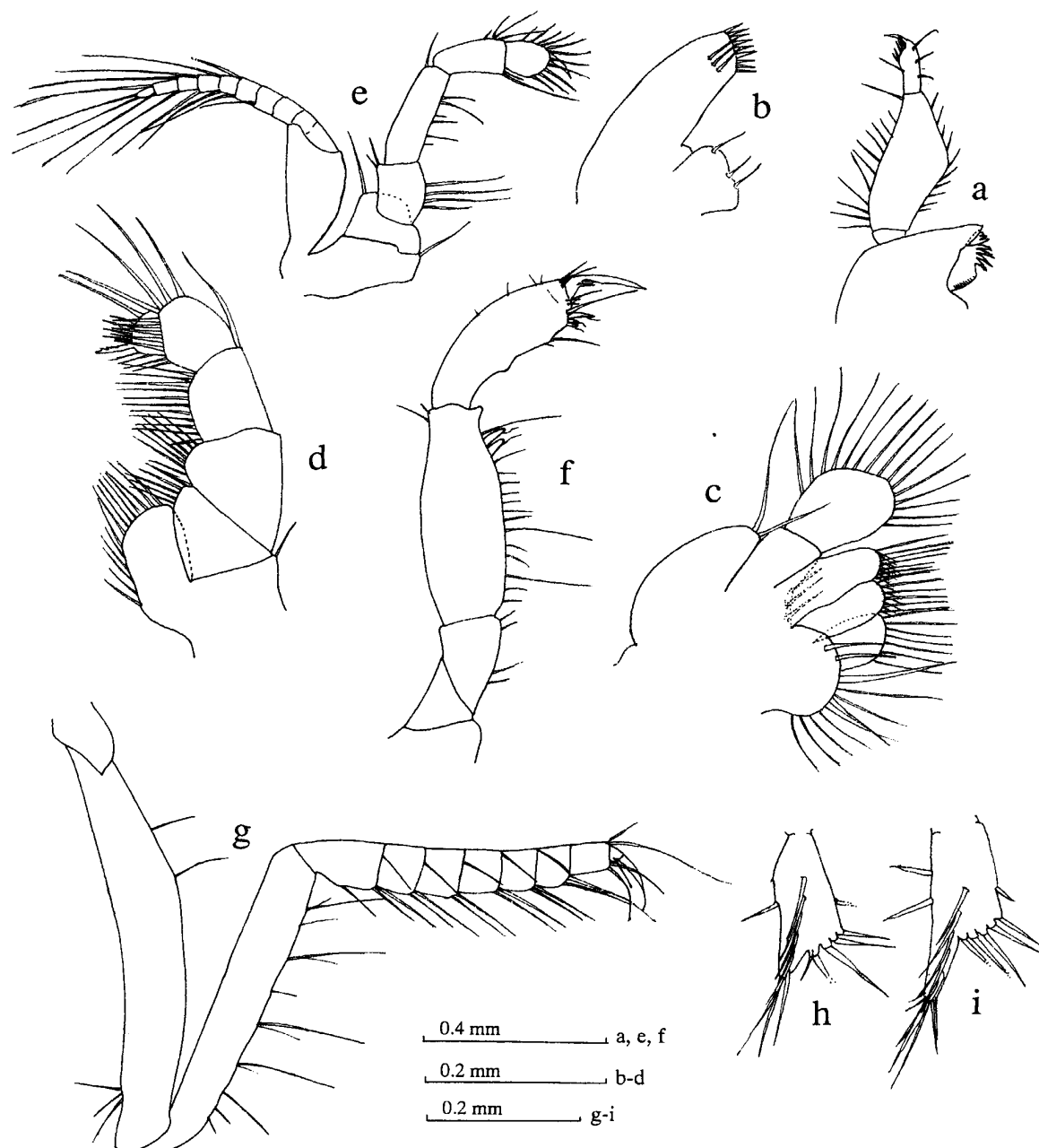


Fig. 2. *Heteromysis dentata* sp. nov. Appendages. Paratype, female (4.0 mm) (a–f) and holotype, ovigerous female (4.4 mm) (g–i): a, right mandible, external; b, right maxillule, external; c, right maxilla, external; d, endopod of right first thoracopod, internal; e, right second thoracopod, external; f, endopod of right third thoracopod, lateral; g, endopod of right seventh thoracopod, lateral; h, left fourth pleopod, lateral; i, left fifth pleopod, lateral.

sixth abdominal somite; endopod 0.83 times as long as exopod, mesial margin weakly convex, unarmed (Fig. 1c, e).

Etymology. The specific name “*dentata*” (=“toothed” in Latin) refers to the distinct distoventral tooth on the merus of the third thoracic endopod.

Distribution. Known only from the type locality. Both specimens were col-

lected by brushing coral rubble partly embedded in the bottom sediment at a point of 30 m from the cave entrance at a depth of 2.0 to 2.4 m.

Remarks. The new species has eyes without an ocular processes, the telson without lateral spines along its anterior half, and the posteromedian cleft of the telson armed with spinules along its entire margin. Of the known Indo-Pacific species of *Heteromysis* [excluding the subgenus *Gnathomysis* of Băcescu (1968)], the following seven species share these features (Table 1): *H. australica* Băcescu and Bruce, 1980; *H. digitata* W. M. Tattersall, 1927; *H. gymnura* W. M. Tattersall, 1922; *H. heronensis* Băcescu, 1979; *H. inflaticauda* Wang, 1998; *H. proxima* W. M. Tattersall, 1922; *H. tethysiana* Băcescu, 1983. The new species can easily be distinguished from all of these by the seven-segmented carpopropodus of the endopod in the posterior four pairs of thoracic limbs. The only possible exception is *H. inflaticauda*, in which the posterior thoracic limbs are unknown, but in this species the endopod of the uropod bears as many as 28 mesial spines (Wang 1998). In addition, the third thoracic endopod of *H. dentata* has a typical form, with a swelling along the proximal two-fifths of the ventral margin of the carpopropodus, as well as an accompanying distinct, distoventral tooth on the merus.

Heteromysis dentata also resembles *H. dispar* Brattegard, 1970, from the western Atlantic Ocean, but the Atlantic species has a three-segmented carpopropodus in the seventh thoracic endopod and the telson abruptly narrows near its proximal end (Brattegard 1970).

Heteromysis longiloba sp. nov.

(Fig. 3)

Material. Holotype: female, 3.0 mm in total length (WAM C 24974), stn. XM2, "Thundercliff Cave" diving site, northern side of Christmas Island, 10°28'21.3"S, 105°36'24.6"E, 30 Nov. 1999, limestone cave more than 100 m long, seemingly connected to land limestone caves, 1.3–6 m deep, totally dark inside, with calcareous and muddy sand bottom, salinity 32‰, leg. S. Ohashi, S. Kinjo, T. Kase, I. Hayami, Y. Kano, and L. Kirkendale.

Description. Body moderately robust, slightly depressed dorsoventrally. Rostrum triangular, directed slightly downwards, reaching midlength of first segment of antennular peduncle, lateral margin weakly concave (Fig. 3a). Carapace rounded dorsally, without cervical groove; posterior margin excavate, leaving last thoracic somite uncovered in dorsal view (Fig. 3a). Ventral sternites without processes.

Abdomen smooth; sixth somite longest, 1.57 times as long as fifth; length ratio of first to sixth somites=0.91:0.91:0.82:0.64:0.64:1.00. No median ventral process present on pleon. Telson subtriangular, 1.27 times as long as sixth abdominal somite, 1.51 times as long as basal width; lateral margins weakly concave, armed with 8 or 9 spines along slightly more than distal half of each side, these spines increasing in length distally; apical lobe with 2 terminal spines, outer spine about 1.3 times as long as inner one; posteromedian cleft deep, occupying slightly less than half length of telson, armed with 8 large spinules only on anterior margin (Fig. 3b).

Eye with cornea well pigmented, slightly narrower than eyestalk, without ocular process (Fig. 3a). Antennular peduncle with first segment with anterolateral

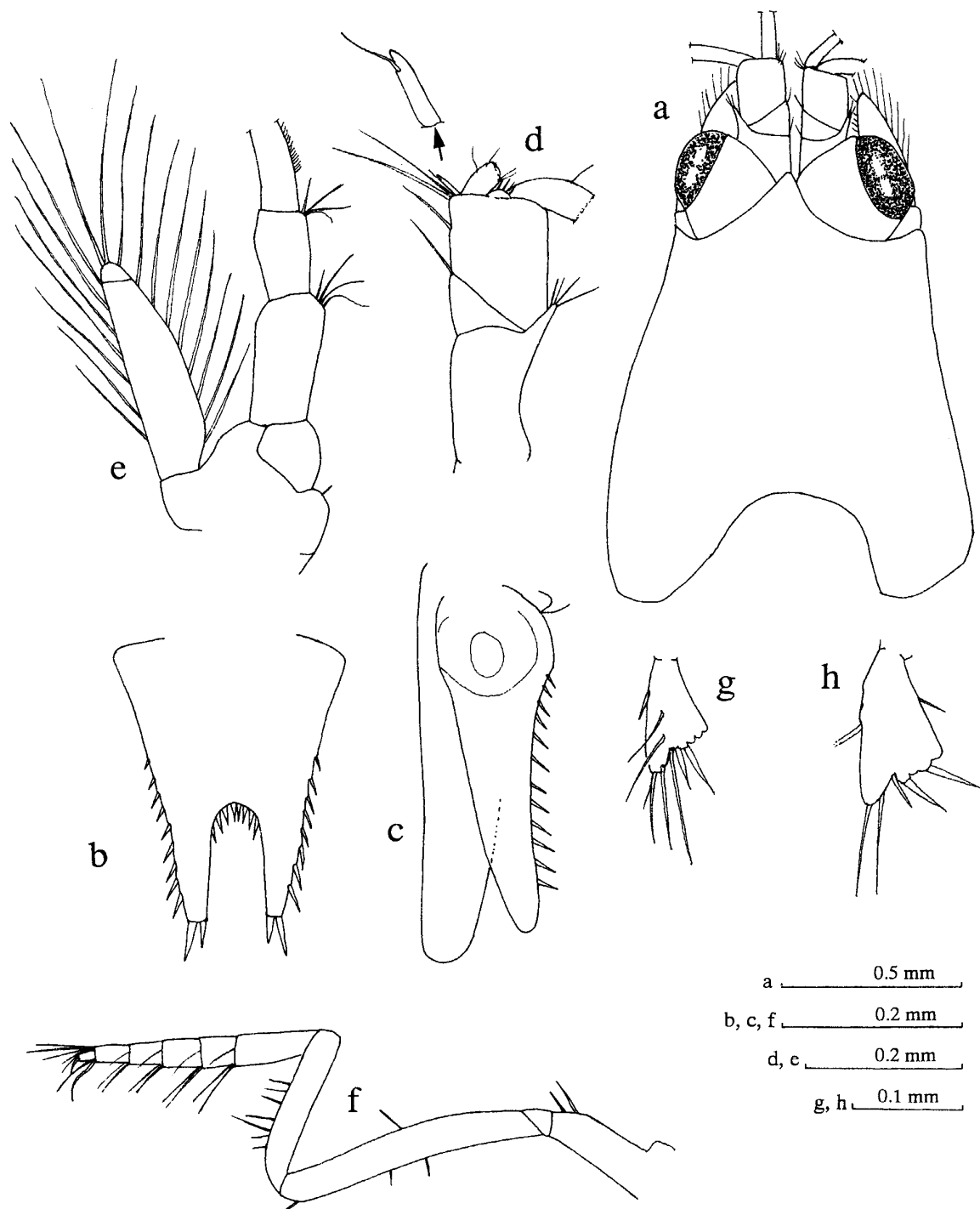


Fig. 3. *Heteromysis longiloba* sp. nov. Holotype, female (3.0 mm): a, carapace and cephalic appendages, dorsal; b, telson, dorsal; c, right uropod, ventral; d, right antennule, dorsal, with detail of flagellate spine; e, right antenna, ventral; f, endopod of left seventh thoracopod, lateral; g, left third pleopod, lateral; h, left fourth pleopod, lateral.

corner strongly produced anteriorly and bearing several distal setae; second segment shortest, articulating obliquely with third segment, and with seta on distomesial margin; third segment widest, with seta at midlength of mesial margin,

and 2 ordinary setae and stout spine distomesially, latter spine bearing subapical flagellum (Fig. 3d). Length ratio from first to third segments along mesial margin = 1.00 : 0.50 : 0.62 (Fig. 3d). Antenna with elliptical scale, latter slightly shorter than antennal peduncle, 3.76 times as long as wide, setose all around margin (Fig. 3e).

All but seventh thoracopods missing; endopod of seventh thoracopod with 5-segmented carpopropodus (Fig. 3f). Pleopods each reduced to unsegmented lobe with pseudobranchial lobe (Fig. 3g, h). Uropod extending beyond posterior end of telson by one-third of length of exopod; endopod slightly shorter than exopod, slightly curving inward, armed with 12 spines along entire mesial margin (Fig. 3c).

Etymology. The specific name "*longiloba*" (= "long lobe" in Latin) refers to the long apical lobe of the telson.

Distribution. Known only from the type locality. The specimen was obtained by brushing coral rubble partly embedded in the bottom sediment at a point of 30 m from the cave entrance at a depth of 5.5 m.

Remarks. This species displays the following combination of major features: eyes without ocular processes; lateral margins of telson unarmed along almost all of anterior half; posteromedian cleft of telson armed with spinules only along anterior margin. The new species resembles the Indo-Pacific *H. spinosa* Băcescu, 1986, but the latter species differs immediately in having a reduced cornea of the eye and an antennal scale that is longer than the antennal peduncle (Băcescu 1986).

The following nine Atlantic species share the features described above: *H. actiniae* Clarke, 1955; *H. bermudensis* Sars, 1885; *H. elegans* Brattegard, 1974; *H. filtelsona* Modlin, 1984; *H. floridensis* Brattegard, 1969; *H. formosa* Smith, 1873; *H. hopkinsi* Modlin, 1984; *H. mariani* Băcescu, 1970; *H. nouveli* Brattegard, 1969. Of these, *H. actiniae*, *H. elegans*, and *H. floridensis* have a slightly curving uropodal endopod as in *H. longiloba*. However, *H. actiniae* bears 40 or more mesial spines on the uropodal endopod and *H. elegans* has no such spines (Brattegard 1969, 1974). The telson of *H. floridensis* is constricted at midlength (Brattegard 1969) as opposed to having an evenly concave lateral margin as in *H. longiloba*.

Discussion

The taxonomy of heteromysids is still far from complete (cf. Bravo and Murano 1996; Nouvel *et al.* 1999). There is also some confusion over the division of the genus *Heteromysis* into subgenera. The following four subgenera have been proposed by Băcescu (1968, 1976): *Gnathomysis*, *Heteromysis*, *Neoheteromysis*, and *Oliwaemysis*. However, several authors seem not to have given full consent to Băcescu's scheme (cf. Brattegard 1970, 1974; Modlin 1984, 1987), and many species are not attributed to a subgenus. Bamber (2000) states that *Heteromysis cyanogoleus* from the Bahamas has features of both the subgenera *Heteromysis* and *Oliwaemysis* in that the male pleopods are characteristic of the former but the antennule is characteristic of the latter. Similarly, *H. dentata* in the present study does not conform to any proposed subgenus in terms of both the absence of a flagellate spine on the antennule and the ventral sternal processes of the thorax. This suggests that the current concept of subgenera is insufficient at least as regards *Heteromysis* and *Oliwaemysis*.

The "*Heteromysis harpax*" species group [i.e. *Gnathomysis* of Băcescu (1968)] is

Table 1. Indo-Pacific species of *Heteromysis* and comparison of key characters.

Species and author/references	Ocular process or projection	Lateral margin of telson with spines along:	Posteromedial cleft of telson with spine (or spinules) along:	Number of mesial spines on uropodal endopod
<i>H. abrucei</i> Băcescu, 1979	present	entire margin	anterior 1/2	2–4
<i>H. australica</i> Băcescu and Bruce, 1980	absent	posterior 1/2	entire margin	1
<i>H. brucei</i> O. S. Tattersall, 1967	present	entire margin	anterior 1/2	5
<i>H. communis</i> Băcescu, 1986	? present	posterior 1/2	entire margin	4–5
<i>H. dentata</i> Hanamura and Kase sp. nov.	absent	posterior 1/2	entire margin	0
<i>H. digitata</i> W. M. Tattersall, 1927	present (overhanging rim)	posterior 1/2	entire margin	0
<i>H. essingtonensis</i> Murano, 1988	absent	entire margin	anterior 1/2	13–15
* <i>H. gerlachei</i> (Bonnier and Pérez, 1902)	absent	posterior 1/2	entire margin	many
<i>H. gracilis</i> Murano, 1988	absent	posterior 4/5–5/6	anterior 3/4	17
<i>H. gymnura</i> W. M. Tattersall, 1922	absent	posterior 1/2	anterior 4/5	0
* <i>H. harpax</i> (Hilgendorf, 1879)	absent	posterior 1/2	entire margin	15–17
* <i>H. harpaxoides</i> Băcescu and Bruce, 1980	absent (cornea reduced)	posterior 1/2	entire margin	14–17
<i>H. heronensis</i> Băcescu, 1979	absent	posterior 1/2	entire margin	2 (widely spaced)
<i>H. inflaticauda</i> Wang, 1998	absent	posterior 1/2	anterior 4/5	28
* <i>H. kossmanni</i> Nouvel, 1964	absent (cornea reduced)	posterior 3/5	entire margin	?
<i>H. longiloba</i> Hanamura and Kase sp. nov.	absent	posterior 3/5	only anterior margin	12
<i>H. macrophthalma</i> Băcescu, 1983	present gap at midlength	entire margin, with unarmed	anterior 2/3	2–4
<i>H. macropsis</i> Pillai, 1961	absent	posterior 1/2	entire margin	8
<i>H. maxima</i> Murano, 1998	present	entire margin	entire margin	4–5
<i>H. minuta</i> O. S. Tattersall, 1967	present (cornea reduced)	posterior 2/5	anterior part	20–22
<i>H. odontops</i> Walker, 1898	present	entire margin	entire margin	4
<i>H. pacifica</i> O. S. Tattersall, 1967	present gap at midlength	entire margin, with unarmed	anterior 4/5	3
<i>H. panamaensis</i> O. S. Tattersall, 1967	absent	entire margin	entire margin	1
<i>H. proxima</i> W. M. Tattersall, 1922	absent	posterior 1/2	entire margin	1
<i>H. quadrispinosa</i> Murano, 1988	present	entire margin	entire margin	4
<i>H. sexspinosa</i> Murano, 1988	present unarmed gap at midlength	entire margin, rarely with	entire margin	2
<i>H. singaporensis</i> O. S. Tattersall, 1967	absent (stalk hispid)	posterior 4/5	entire margin	13
* <i>H. stellata</i> Băcescu and Bruce, 1980	absent	posterior 1/2	entire margin	15–17
<i>H. spinosa</i> Băcescu, 1986	absent	posterior 1/2	anterior 1/2–1/3	6–11
<i>H. tenuispina</i> Murano, 1988	present	posterior 2/5	anterior 1/2	9
<i>H. tethysiana</i> Băcescu, 1983	absent	posterior 2/5	entire margin	0
<i>H. waitei</i> W. M. Tattersall, 1927	present	almost entire margin except for distal and proximal ends	entire margin	3–4
<i>H. xanthops</i> Ii, 1964	absent	posterior 1/2	entire margin	14–15
<i>H. zeylanica</i> W. M. Tattersall, 1922	present	entire margin, with unarmed gap at midlength	anterior 1/2–2/3	11–13

**H. harpax* species group [subgenus *Gnathomysis* of Băcescu (1968)]

characterized by a very robust third thoracopod with a serrated ischium. Species of this group can be recognized easily by this structure (Nouvel 1964; Băcescu 1968, 1980), and, consequently, the group appears to be isolated from the others. The sub-genus *Neoheteromysis* contains a single species, *H. muelleri* Băcescu, 1976, distinguished from all the remaining species of *Heteromysis* by its remarkable fourth pleopods with extraordinarily long apical setae (Băcescu 1976), for which Nouvel *et al.* (1999) raised it to full generic rank.

Although a degree of confusion remains in the taxonomy of *Heteromysis*, our knowledge of the Indo-Pacific species has progressed greatly in the last two decades and 33 species are recognized from the region, including the two new species in this study. These species are listed in Table 1 along with their major characteristics.

Species of *Heteromysis* have been reported from diverse types of habitat, and most species have a cryptic mode of existence, living in association with sponges and corals or as commensals with various invertebrates (see also Müller 1993). Only three species of *Heteromysis* have as yet been recorded from submarine caves (Băcescu and Iliffe 1986; Bamber 2000). Submarine caves in the Indo-Pacific remain largely unexplored, and surveys of this habitat will likely produce further undiscovered species of *Heteromysis* in the region.

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